The British Veterinary Journal

NOVEMBER 1959

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Vol. 115 **November 1959** **No. 11**

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EDITORIAL

VETERINARY ANCILLARY SERVICES

Doctors of men and animals have much in common. Their work is centred on the relief of pain and distress, the treatment and prevention of disease, the correction of those injuries and abnormalities which are occasioned by accident or faulty development of the body, and the promotion of all the factors which are essential to the maintenance of good health.

In pursuance of these aims they have again much in common. Recruits to both professions come from all classes of society, the preliminary educational standards are the same and the course of training in a medical or veterinary college is orientated around similar disciplines. After the under-graduates have qualified, and been acknowledged as competent to practise the art and science of their particular callings, the manner of their life and conduct is regulated according to almost identical rules. In all these things the professions are on very equal ground.

When a young veterinary graduate sets forth to practise his art and science in the world he soon becomes aware that the era of very close similarity in endeavour, and outlook, has ended. The work of medical men is not restricted in any great extent by the economic factors which beset a veterinary surgeon. A general practitioner of medicine has access to a host of specialists to whom he may refer when in doubt, there are hospitals to receive his patients, efficient nursing services, and a variety of ancillary workers available for duty at his behest. A medical man need not continue to bear the whole responsibility for an unusual or troublesome case. A slip of paper can be a passport to freedom and relaxation. He can " pass the buck " and often his pen is mightier than a scalpel. Some have achieved great prowess in this art and would pass fair muster as clerks in a government office. The lot of a practising veterinary surgeon is vastly different. He stands alone. He has to bear the responsibility of both physician and surgeon. There are no hospitals or trained nursing teams at his call and in most instances he has to provide the ancillary service that may be required for radiographic and biochemical investigations. In some ways it is a good thing that a veterinary surgeon has to be self-reliant in such a wide and miscellaneous way. It makes him tough and confident, it widens his outlook and

enhances his all round competence at his job, and he becomes very skilled in the art of improvisation. Extreme specialisation as practised in other professions has its good points but it has its faults also. A man can become extremely learned and skilled in the treatment of the ailments that affect one small section of the human frame and become indifferent and forgetful, or even ignorant of, the troubles of other parts.

The animal body is one of the most delicate and intricately constructed marvels of nature. The various parts and systems are co-ordinated with a sensitive trigger-like accord, and it is rare for one section to suffer upset without some warnings or repercussions in other parts. The extreme specialist can become so obsessed with the details of his own specific sphere that he may lose the ability to take stock of the body as a whole, and he may fail to see and recognise strong signals which flash warnings of danger in other parts.

A veterinary surgeon cannot live in an isolated tower and look out of one window only. He has to retain a broad view and do his best in a variety of circumstances which, if they were translated into human medicine, would require the services of a general hospital. In the past, and even at the present time, there has been very little opportunity for a veterinary surgeon to specialise in any particular facet of medicine or surgery. If he did so the opportunities to practise his skill are few for economic reasons, and he would fain achieve a reasonable reward. In his own interest and in that of his clients and patients probably it is best if he retains a broad outlook and develops a reasonable all round competence, supported by a high degree of common sense and good judgment. There is one sphere in which his task could be lightened and with advantage to his patients. It concerns the ancillary services. It would be a great boon if there were available throughout the country a service of competently trained animal nurses, together with regional animal hospitals, radiographers, physiotherapists, and technicians able to undertake routine biological tests. It is common knowledge that one of the most valuable assistants in a veterinary practice is the handyman or woman who can undertake routine first aid and nursing duties.

The time has come when these essential ancillary services should be organised on a sound basis. The method of training and the requisite tests of competence could be devised. If a register were kept of those who qualify, veterinary surgeons would know where to seek assistance.

Medical men take full advantage of the services of people who do not possess the qualifications of the registered practitioner.

These assistants perform a variety of tasks with a great degree of reliability and efficiency and the doctor is relieved of many duties of a time consuming routine nature.

In consequence he can devote his full attention to those matters which do require his more specialised and higher knowledge for their solution.

Veterinary surgeons would do well to follow the lead of their medical confrers.

XUM

THE ARTERIAL CIRCULATION OF THE KIDNEYS OF THE ELEPHANT AND GREY SEALS

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Few opportunities arise of examining the kidneys of sea mammals. Often when material does become available, its condition is such that study by any injection methods, which demand fresh undamaged material, is useless.

Most of the material of value which has been examined in this department during recent years, has been kindly supplied by Dr. Appleby of the Royal Scottish Zoological Gardens, Edinburgh, to whom many thanks are due for the care with which he has selected and dispatched the material to me.

Recently, excellent specimens of the kidneys of the Elephant Seal (Macrorhinus leoninus) and the Grey Seal (Halichoerus grypus) came to hand.

The method adopted to examine them was to perfuse the arteries of one kidney of each animal with warm saline, followed by a twelve per cent. solution of red-coloured Vinylite at a pressure of 100 mm. of mercury. (Grahame 1944). The ureter of one kidney of each animal was injected in similar fashion with an eighteen per cent. solution of uncoloured Vinylite.

This method generally, provides casts of the arterial and ureteric systems which are less brittle than those of other resins and which may be handled with impunity. Further, provided the casts are kept moist, their shape and colour appear to last indefinitely.

The Kidney of the Elephant Seal: This mammal is found in the Antarctic seas and off the coast of California. It is the largest member of the family, reaching an adult length of nearly 20 feet, it has a short tubular proboscis capable of elongation and dilatation under stress or excitement.

Its kidneys are not as large as might be expected but they do appear to bear a reasonable ratio to body weight. Most characteristic feature is the marked lobulation of the organs and, once fat is removed from deep fissures, about 300 lobules may be counted in each kidney.

Another feature of note is the lack of indentation in the medial border of the kidneys, although the hilus, occupying a small area where renal vessels enter and leave, is situated as in other mammalian kidneys, near the middle of the medial border.

The cranial extremity is 'sharper' than the caudal, another factor common to many mammals. Apart from these extraneous characters, however, there were no others worthy of note. Accordingly, investigation of the interior of the kidneys was carried out by injection techniques noted above.

The cast of the arterial system is defined with great clarity in Fig. I. It can be seen that the renal artery is short and runs towards the ventral surface of the kidney where it immediately divides into two large lobar vessels. The caudal is the larger and it soon gives off a third large lobar trunk. No doubt it will often happen that in many cases the renal arteries themselves give rise to these three lobar vessels.

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From the lobar arteries numerous interlobular arteries are given off and these soon break down into the arciform vessels. From these spring the intralobular vessels to form the ' rosettes ', and also to present and confirm the lobulated conformation, giving the cast its striking appearance, close examination of which reveals the minute afferent capillaries.

In the specimens, both glomeruli and efferent capillaries might have been injected but these would inevitably have become dislodged during maceration. Because of this, any attempt to demonstrate the latter would have required a slightly different technique, using small portions of kidney and digesting away the tissue with trypsin in a warm bath followed by examination of small pieces under the microscope.

Each rosette is a complete vascular unit; it has no connection or anastomosis with adjacent rosettes. Nor does there appear to be any anastomoses between the vessels within the rosette. Furthermore, there are no anastomoses between any of the larger vessels outside the rosettes. Occasionally, however, from the lobar and interlobular arteries, small vessels run through the capsule to the perirenal tissue and others to the ureter and its calyces.

The ureter is a fairly wide tube, but after leaving the hilus it becomes constricted and then slightly dilated almost forming a pelvis before breaking up into large calyces. From these finer tubes arise which terminate ultimately in smaller cup shaped calyces (Fig. II).

Each of the cups is applied to the papillary part of a lobule. The number of cups and rosettes correspond. The visible lobulation, the vascular rosettes, the absence of anastomoses between the rosettes, and the correspondence in number to the lobules of the cup shaped calyces give adequate morphological evidence that each lobule is an independent unit—in other words, a small kidney. Thus it is not hard to assume that these lobules are simply renal pyramids, each with its appropriate part of cortex and each functioning as a kidney in perfect autonomic nervous co-ordination.

The Grey Seal (Halichoerus grypus) is common round the coast of Britain and, is not so large as the above. Neither is the kidney so large. It is, however, in similar ratio to body weight, and lobulated, the lobules not being so numerous.

The casts of the vessels and ureter have a very similar appearance to those of the Elephant Seal, a point worthy of note, for it has previously been observed that the kidneys of other sea mammals examined in the manner given, present an almost similar structural pattern. These are the Northern Sea Lion (Otaria stelleri), Common Seal (Phoca vitulina), Grey Seal (Halichoerus grypus), and Bottle-nosed Whate (Hyperoodon rostratus) (Grahame, 1953).

Acknowledgments

It is only after many years of practice, and the ultimate specialisation of a technique, that Mr. E. Roberts, Head Technician in this Department, has been able to produce such lovely specimens. My thanks must also be extended to Mr. R. Hood for the excellent photographs.

REFERENCES

Grahame, T. (1944): The kidney of the Indian elephant (Elephas indicus). *Brit. vet. J., 100* 97.
Ibid (1953): The Pelvis and Calyces of the Kidneys of Some Mammals. *Brit. vet. J., 109*, 51.

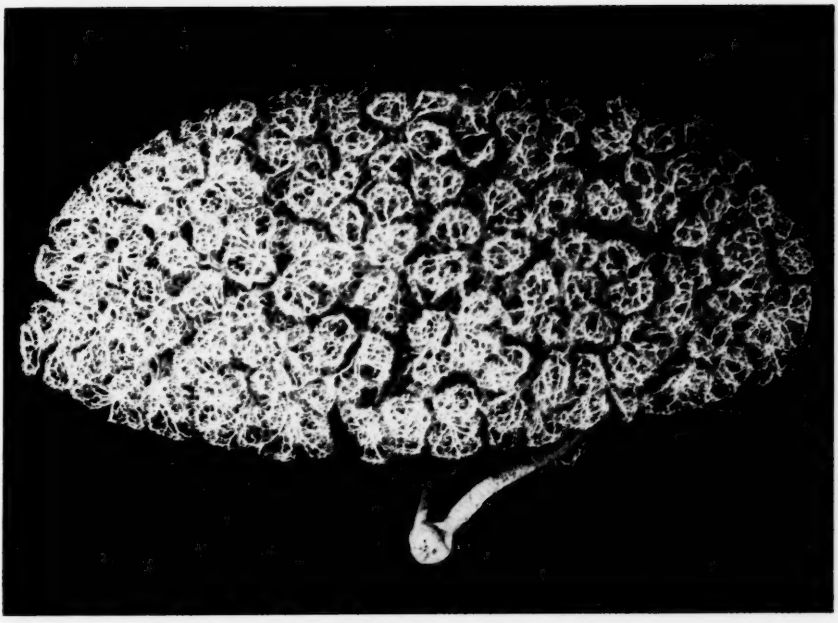

FIG. I.
Arterial rosettes, kidney Elephant Seal.

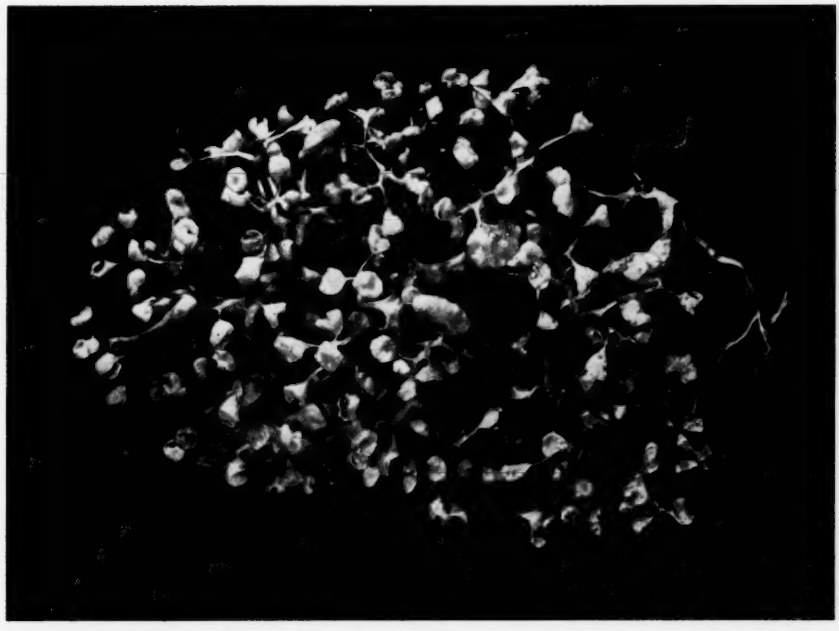

FIG. II.
Ureter and calyces, kidney Elephant Seal.

(Article by Grahame, page 397)

XUM

THE USE OF THE OESTROSCOPE AND ITS VALUE IN DETECTING OESTRUS IN DAIRY CATTLE

by
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In 1941 Scott Blair, Folley, Malpress & Coppin (1941 a, b, c) designed and constructed an instrument which they named an oestroscope and which enabled them to study the changes that occur in the ' flow-elasticity ' of cervical mucus during the oestrus cycle in cows. They concluded from their tests that the oestroscope should be of practical value in predicting oestrus in animals in which it is likely to be missed and for diagnosing oestrus where ovulation is not accompanied by any external indications. In their early experiments with four cows Scott Blair *et al.* (1941 a, b, c) examined samples of mucus at intervals of 4 or 5 days and also a sample taken on the day oestrus was observed. The results they obtained indicated that the ' flow-elasticity ' values reached a high value at the time of oestrus.

The tests described here were made to obtain more information on the value of the oestroscope for detecting oestrus under practical conditions.

Materials and Methods

Cattle

The intention was to use twenty of the Ayrshire cows and heifers in the Institute herd for this investigation, but at an early date one of them had to be withdrawn. Seven of the remaining nineteen animals were in their first lactation, seven in their second and third lactations, and the remaining five in their fourth to tenth lactations. The nineteen animals had all calved normally without assistance. The dates of calving ranged from August 9th to October 9th, 1957, with thirteen of the calvings occurring in September. Details of calving dates and lactation numbers are shown in Table 1. The cattle were on pasture day and night until October 20th. After this date they were housed for the winter and were fed hay, silage and kale, but each morning they were allowed into a bare grass paddock for 3 hours.

Frequency and time of sampling

During the first 3 weeks of the experiment samples were taken every 3 or 4 days, but after that an attempt was made to take samples daily although this was not always possible with every animal. All the samples were taken from the cows when they were tied, in the normal way, in the byre. In the early part of the experiment when the cows were at grass the samples were taken just after the morning milking, but when the cows were housed for the winter, they were usually taken just before the afternoon milking.

The samples were taken between October 1st and December 31st, 1957.

Equipment used to take mucus samples

Polythene tubes of outside diameter 11.0 mm.; bore 5.0 mm.; and 43 cm. in length were used to take the samples of vaginal mucus. The non-penetrating end

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TABLE 1.
Calving dates and lactation numbers of the cows.

Cow No.	*Date calved in autumn 1957*	*Lactation number during the period of the tests*
1	28 Sept.	6+
2*	3 Oct.	10
3	23 Sept.	2
4	29 Sept.	1
5	19 Sept.	1
6	27 Sept.	1
7	15 Sept.	1
8	29 Sept.	3
9	3 Oct.	4
10	1 Oct.	4
11	14 Sept.	1
12	27 Sept.	3
13	19 Sept.	3
14	9 Aug.	5
15	26 Aug.	3
16	28 Sept.	9
17	24 Sept.	1
18	2 Oct.	2
19	9 Oct.	1
20	29 Sept.	2

*No. 2 was removed from the experiment at an early date

of each tube was plugged with cotton wool. This plug served a dual purpose; firstly to retain the mucus in the sampling tube and secondly to act as a plunger so that the mucus could be expelled from the tube by means of a long piece of wire. The suction apparatus consisted of a mouthpiece made from polythene tubing (9.0 cm. long), a short rubber tube (35 cm.) a trap bottle of 40 ml. capacity and a long rubber tube (65 cm.).

The volume of mucus obtained at one sampling varied up to 8.5 ml. At least 0.5 ml. of mucus was required to make a satisfactory test with the oestroscope, although tests were occasionally made with as little as 0.35 ml.

Sterilization of sampling tubes

Cold water was run through the sampling tubes after use, and, after thorough cleaning, they were placed in a disinfecting solution consisting of 1.5% cetrimide in a suitable jar. After 24 hours the tubes were drained and placed in a sterile pipette canister and the ends plugged with cotton wool ready for use.

Use of the oestroscope

The oestroscope consists of a glass capillary tube of about 2 mm. bore and about 11 cm. long graduated in millimetres. One end is cemented into a metal spout which fits on to the nozzle of a 2 ml. hypodermic syringe. Between the shank and the 10 cm. mark is an open side-tube. The instrument and the method of using it have been described by Scott Blair *et al.* (1941, a, b, c). Briefly the method consists of drawing mucus up to the 10 cm. mark, wiping the end clear of mucus, slowly forcing the mucus out of the tube until the meniscus reaches the 7 cm. mark and then suddenly releasing the pressure by removing the thumb from the side-tube. The ' flow elasticity ' of the mucus causes the meniscus to recoil along the tube. In the

present work the measure of ' flow elasticity ' is given as the percentage of the recoil to the length of the column of mucus extruded.

Usually the samples were tested immediately after they were taken, but occasionally a period of 1 to 1½ hours elapsed before testing, but Scott Blair *et al.* (1941 a) showed that samples could be kept at room temperature for 2 days or more without any significant change occurring in their ' flow elasticity '.

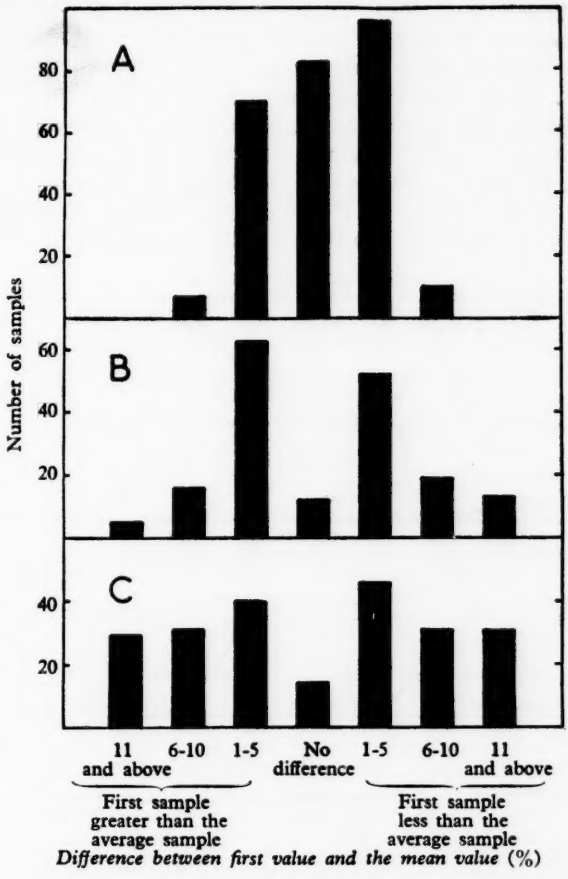

FIG. 1

The distribution pattern of the variations found between the first measurement of the recoil value on a sample of mucus and the mean value of all the measurements on that sample.

A. 266 samples with average ' flow elasticity ' values of up to 20%.
B. 179 samples with average ' flow elasticity ' values ranging from 21 to 40%.
C. 202 samples with average ' flow elasticity ' values greater than 40%.

Recoil values

The recoil values or measures of ' flow elasticity ' are shown graphically in Figs. 2, 3 and 4.

Results

Samples and sampling error

Over 750 individual samples were examined and unless the specimen was scanty (<1.0 ml.) three or more tests were made on each one.

Twenty samples, on which only duplicate determinations could be done, had a mean value of 25.0 with a standard deviation of ± 8.0 and a coefficient of variation of 32%. A different set of twenty random samples tested in triplicate averaged 32.0 ± 3.4, the coefficient of variation being 11% whereas a further batch of twenty random samples done in sextuplicate averaged 59.3 ± 13.2 with a coefficient of variation of 22%. These values give some indication of the variability of the samples and of the results obtained in individual tests on the same sample. They suggest that in the case of samples with low values (<about 40) there was a decrease in the variability of the results where samples were tested three times instead of only twice. With samples of higher values (>45) the variation in individual results for the same samples was large, but, as will be seen later, this did not affect the conclusions drawn from the results.

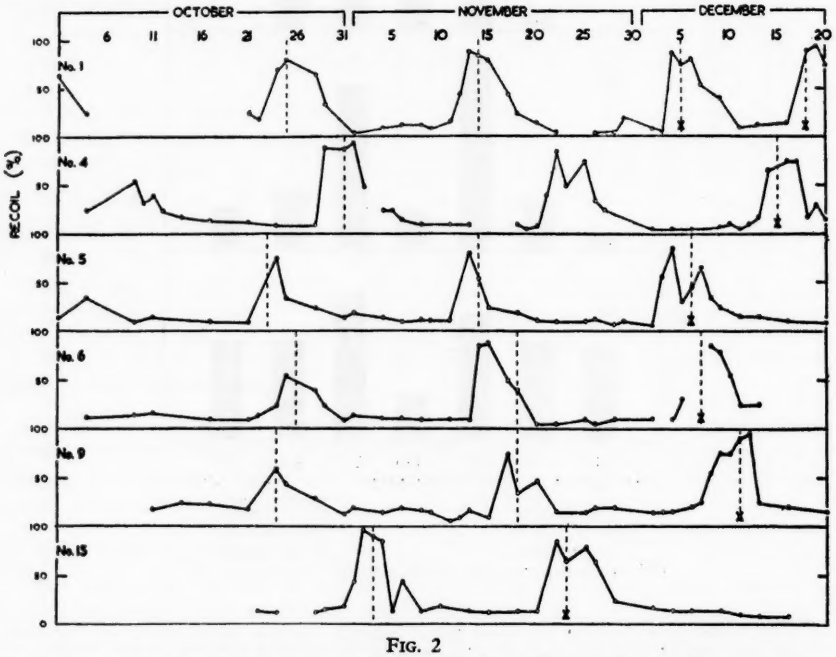

FIG. 2

Oestroscope readings of six of nine cows which showed regular periodic rises in the values of 'flow elasticity.'
A vertical dotted line indicates the day on which oestrus was observed and a cross the day of service.

In order to test further the value of doing more than one test on each sample of mucus a comparison was made between the first result found with each sample and the mean value of all the individual tests done on the same sample. In samples

with mean values of 20 and below, 94% of the first values were within ±5% of the corresponding mean values. With samples for which the mean values ranged from 21 to 40, the number of samples that were within ±5% of the corresponding mean values was 70%. Where the mean values exceeded 40 the figure of 70% was reduced to 50%. The wider discrepancies with the higher recoil values between the results of several tests on the same sample were not important in practice since the important changes that occurred in the recoil values during the oestrus cycle were so marked. Distribution patterns of the results are illustrated in Fig. 1.

Nine of the nineteen cows showed regular periodic rises in the ' flow elasticity ' of the vaginal mucus from a steady level of about 10% during the dioestral period up to 50 to nearly 100% around the time of oestrus. The rise began to occur 2 to 5 days before the day of observed oestrus, and did not fall to the 10% level till 2 to 7 days after it. Eight of these animals held to the first service; the ninth, an old cow (cow No. 1) was not in calf even after six services. The results for six of these cows are shown in Fig. 2.

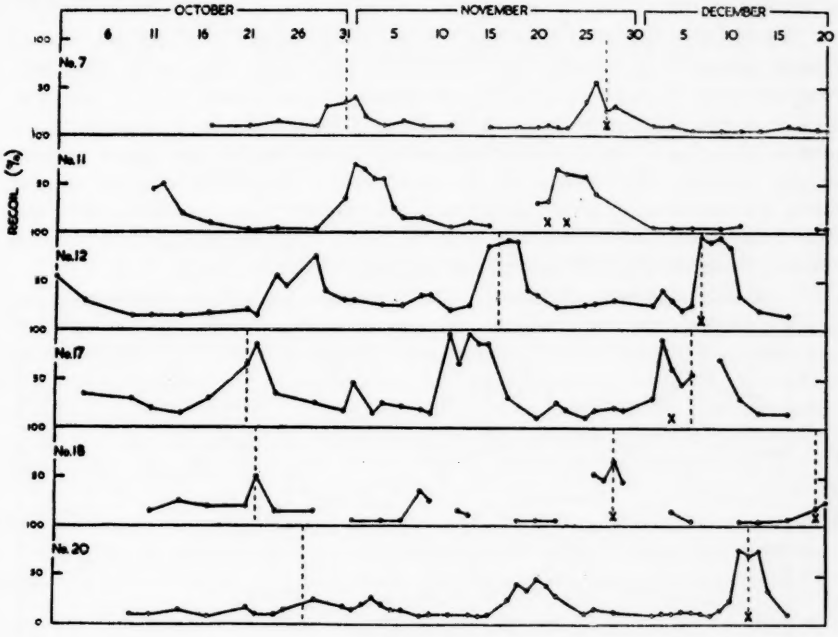

FIG. 3

Oestroscope readings of six cows which were irregular either in the period or in the extent of the rise in the values of ' flow elasticity '.

Fig. 3 shows the records of six cows which in various ways were different from the nine cows to which reference has just been made. Cow No. 7, a first calf heifer, showed regular peaks, but the ' flow elasticity ' did not rise above 50% and in addition the dioestrus level was below 10%. This animal conceived at the first service. Cow No. 11 showed even lower dioestrus levels, but there were quite high

levels at regular intervals. This animal was never observed to be in oestrus probably because lameness restricted her activities when in the field. She was served twice, however, during the peak in the ' flow elasticity ' graph in late November and held to one or other of these services. Cow No. 12 showed particularly high levels of ' flow elasticity ' of the mucus (about 90%) around the times of observed oestrus, but also relatively high levels (30%) at dioestrus. This animal was giving the highest yield of milk in the group and was served four times before she eventually conceived. Cow No. 17 showed very high peaks, but at dioestrus the levels of ' flow elasticity ' were irregular and somewhat high. This animal became pregnant after the second service. Cow No. 18 was a difficult cow to sample and often the mucus obtained was too little to test. Dioestrus samples tended to show low ' flow elasticity ', but on the occasions when oestrus was observed there appeared to be small peaks in the values obtained. This animal became pregnant after the second service. Cow No. 20 showed no peak at the first appearance of oestrus, but at the second period of observed oestrus there was a very marked increase in the ' flow elasticity '. This cow became pregnant at the first service.

The dates on which the cows were ' in season ' as judged by observation of their general behaviour in the byre and towards the other cows when in the field were compared with the dates when the highest reading of ' flow elasticity ' was measured. Details of this relationship are given in Table 2 for a total of 32 observations of oestrus. For nine of the 32 observations oestrus occurred on the same day as the peak in the ' flow elasticity ' value. For ten it occurred 1 day before the peak and for eleven it occurred 1 day after. In the remaining two instances oestrus occurred more than 1 day after. This means that 94% of the 32 observations of oestrus occurred within ± 1 day of the peak in the ' flow elasticity ' value.

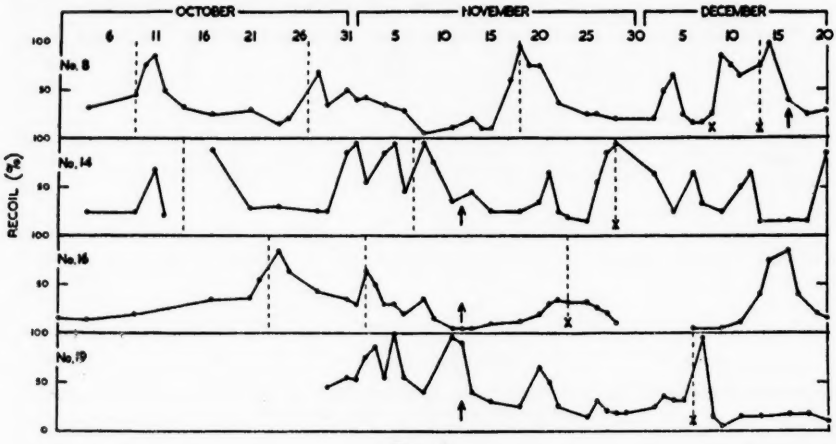

FIG. 4

Oestroscope readings of four cows found to have cystic ovaries.
An arrow indicates the day on which cystic ovaries were diagnosed and treated.

The interval in days between the highest readings of ' flow elasticity ' from one peak to another was recorded. During the experiment twenty-seven values for this

interval were obtained for the fifteen normal animals. The average period was 21.3 ±2.3 days.

TABLE 2.

Number of days by which the peak of 'flow elasticity' differed from the day on which oestrus was observed in the 15 normal cows.

Cow No.	*Number of instances where observed oestrus was:—*			
	1 day before the peak	*On the same day as the peak*	*1 day after the peak*	*More than 1 day after the peak*
1	1	1	2	—
3	—	2	1	—
4	2	—	—	—
5	1	—	1	1
6	1	—	1	1
7	1	—	1	—
9	1	1	1	—
10	—	2	—	—
11	Never observed in oestrus			
12	1	1	—	—
13	1	—	1	—
15	—	—	2	—
17	1	—	—	—
18	—	2	—	—
20	—	—	1	—
Total (32)	10	9	11	2

Fig. 4 gives records of the remaining four cows in the experiment which all showed an irregular pattern of 'flow elasticity'. Because of this irregularity the cows were examined. They were all found to have cystic ovaries and treatment was attempted. The service records of these cows were as follows: cow No. 8 was served twice within 5 days during a period when the 'flow elasticity' was at a peak, and it conceived after one of these services; cow No. 14 became pregnant after the first service; cow No. 16, an old cow, conceived after the fourth service; and in cow No. 19 the third service was successful.

Fertility

The daily sampling of the mucus did not appear to interfere in any way with the fertility of the cows, and all but one of the nineteen animals eventually conceived.

Discussion

The results of this investigation agree with those of Scott Blair *et al.* (1941 a) in showing that the 'flow elasticity' of the vaginal mucus of the cow increases around the time of oestrus, but the main object of the present work was to assess the probable value of the oestroscope for detecting oestrus in the cow under practical farm conditions. The total cost of the equipment is at present £7, so that if the oestroscope were shown to be of real practical value on the farm for detecting oestrus accurately, cost alone would certainly not hinder its use.

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The present work showed that regarding the actual technique of making the test, if only one determination was made on each sample of well mixed mucus, a satisfactory result would be obtained under most conditions. Where a first value was doubtful or where greater precision was required a duplicate determination would be essential, but usually nothing of value would be gained by making further determinations. Although the test can be done rapidly and easily by people accustomed to making tests with laboratory equipment, the experience gained in the present work made it difficult to picture the practical farmer using the oestroscope under ordinary farm conditions.

With the fifteen normal cows used in this investigation, in 30 of the 32 observations visible signs of oestrus occurred either on the day on which the ' flow elasticity ' was at its maximum or within 1 day before or after the peak was reached. It appears, therefore, that with normal cows and complete daily records it would often be possible to conclude in retrospect that a cow had almost certainly been in oestrus on one of three consecutive days, but it would not be possible to be sure of the precise day either in retrospect or at the time of sampling unless the usual external signs of oestrus were visible. If the external signs were not visible, the occurrence of oestrus might readily be missed unless sample of mucus were being examined regularly and almost daily. With *normal* cows, therefore, the oestroscope would not be likely to be of much practical value to the farmer.

It should be noted, however, that with abnormal cows and in the hands of one who is accustomed to making tests with laboratory equipment the use of the oestroscope might well be helpful. For example, in one of the nineteen cows used in this work (No. 11) the usual signs of oestrus were never observed, and yet for this cow the oestroscope showed a regular and typical pattern of ' flow elasticity ', and when this cow was served on the day suggested by the oestroscope test the service was successful. It is not known, of course, whether with other cows showing no visible signs of oestrus the oestroscope would be so helpful, but it seems fairly certain that at any rate in many similar instances it could be expected to give the same reliable result.

The tests revealed marked abnormalities in the oestrus cycle in four of the nineteen cows, and this led to a more detailed veterinary examination with ultimately successful results in all of them.

Summary

1. Details are given of the equipment required for taking samples of vaginal mucus and determining its ' flow elasticity '.
2. Examination was made of more than 750 samples taken from nineteen autumn-calving Ayrshire cows and heifers between October 1st and December 31st, 1957.
3. Nine of the nineteen cows showed regular periodic rises in the ' flow elasticity ' values; for a further six of the cows the changes were less regular and some of the rises were less marked. The remaining four cows were found to be abnormal and were all shown later to have cystic ovaries.
4. For the fifteen normal cows the average time between peak values of ' flow elasticity ' was 21.3 ± 2.3 days.
5. Omitting the results for the four abnormal cows, visible signs of oestrus occurred either on the day of the peak value of the ' flow elasticity ' or within one day before it or one day after it for 94% of all the observations.

6. Although the oestroscope test costs little and can be done rapidly and reliably by people who are accustomed to making tests with laboratory equipment, it does not seem likely that farmers would use it, particularly when it is realised that isolated observations would be of little value. The instrument would have to be used over a period of at least several days to give an indication or prediction of oestrus that was likely to be reliable.
7. Under experimental conditions and where there appeared to be some abnormal condition or no visible signs of oestrus, the oestroscope in practised hands might well be of considerable value.

The authors are indebted to Dr. G. W. Scott Blair and Mr. F. A. Glover of the National Institute for Research in Dairying for their help and advice in the use of the oestroscope.

REFERENCES

Scott Blair, G. W. Folley, S. J., Malpress, F. H. and Coppen, F. M. V. (1941a): *Biochem. J.*, *35*, 1039.
Scott Blair, G. W., Folley, S. J., Malpress, F. H. and Coppen, F. M. V. (1941b): *Vet. Rec.*, *53*, 693.
Scott Blair, G. W., Folley, S. J., Coppen, F. M. V. and Malpress, F. H. (1941c): *Nature* (*Lond.*), *147*, 453.

ON A HITHERTO UNDESCRIBED VALVULAR APPARATUS IN THE ADRENAL GLAND OF THE SHEEP

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Introduction

The structure of the central medullary veins of adrenal glands in general has been the subject of much postulation in the literature, especially with regard to the presence or absence of plain muscle fibres in the vessel walls.

In 1906, Ferguson stated that all efferent veins in all adrenals are characterised by having smooth muscle fibres in their walls. Bargmann (1933) refuted this statement and presented a list of animals in whose adrenals he was unable to demonstrate muscle at all. He included the sheep in his list.

Trautmann and Fiebiger (1952) agree with Bargmann's findings and go a step further by stating that ruminants in general are lacking in adrenal medullary muscle.

Whilst these observations are contrary to the situation in the human gland, in which Ferguson (1906), Kolmer (1918) and Bargmann (1933) have noted longitudinal plain muscle fibres in the walls of the central medullary vein and in those of some of its larger tributaries, study of sections stained with Masson's trichrome and other selective stains shows there can be no doubt that in the sheep medullary veins are completely devoid of muscle fibres of any kind.

Whilst muscle fibres may be absent from the medullary veins of the sheep's adrenal, this is not so with regard to the vena cava in which longitudinal and circular plain muscle fibres are very obvious.

The presence of these fibres and especially the plane in which they run is interesting in relation to a valvular apparatus which was noted in the region of the adrenal and the caudal vena cava, during routine dissection of sheep for general research purposes. No reference to such an apparatus could be found in the literature, so it was decided to make further observations, and a series of right adrenals were obtained from 48 Half-bred sheep which had been slaughtered at the City Abattoir, Edinburgh.

Observations

The right adrenal of the sheep is situated between the medial surface of the anterior pole of the right kidney, and the lateral border of the caudal vena cava. It can be considered as having three borders and three surfaces. Of these, only the medial surface is of concern in this paper.

It is narrow straight and it is of considerable importance to note that for almost all its length, the adrenal capsule is blended intimately with the outermost layers of the vena cava.

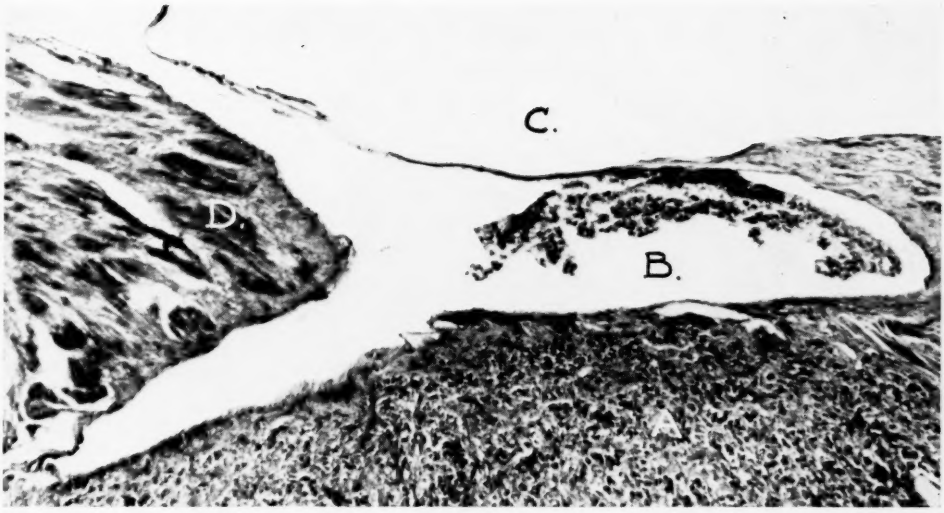

FIG. 1.

Valvular apparatus of right adrenal of sheep in horizontal section. A—Odrenal. B—Central medullary vein. C—Caudal vena cava. D—Caval wall. Haematoxylin and eosin x 950.

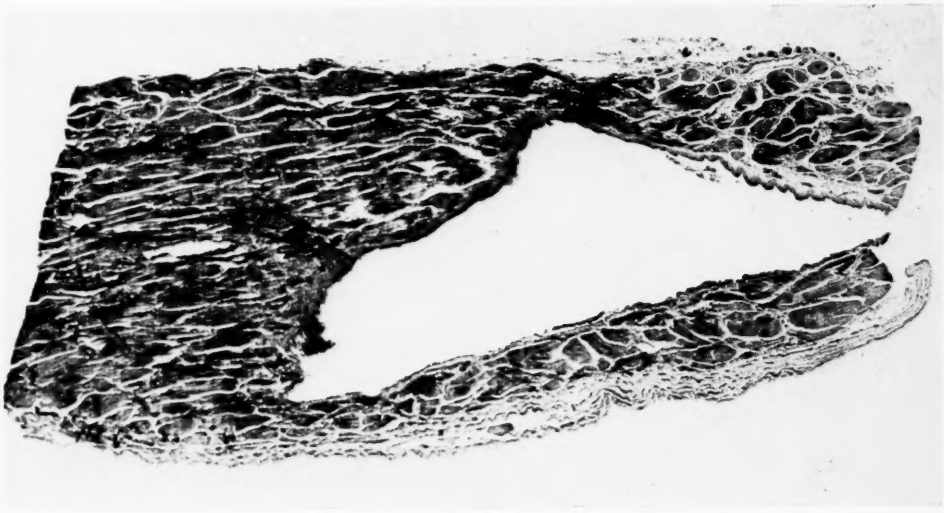

FIG. 2.

Sagittal section of the wall of the vena cava and the tunica media of the valve, showing entrance to right central medullary vein. Note the direction of muscle fibres in the valve. Masson's trichrome x 600.

(Article by Stokoe, page 408)

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PLATE 3

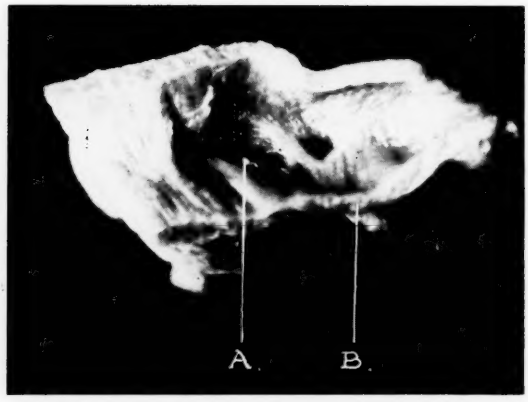

FIG. 3.

Apertures in the caval wall from the right central adrenal medullary vein. Endothelial valve is marked 'A'. Wall of veno cava—'B'.

(*Article by Stokoe, page 408*)

The central medullary vein opens on the medial surface of the gland directly into the lumen of the vena cava either by a single large aperture of a maximum of four small ones. In all of the specimens examined, these apertures were found to be partially occluded by a flap of endothelial-type tissue which was continuous with the lining membrane of the vena cava (Fig. I).

The flap lay along the direction of blood flow in the vena cava and further inspection demonstrated that it consisted of three distinct tunics. The innermost, facing the lumen of the medullary vein, was formed by a single layer of endothelial cells which were continuous with those of the wall of the medullary vein.

The outer tunic also consisted of a single layer of endothelium which was a continuation of that of the tunica intima of the vena cava. Both these endothelial tunics united at the free border of the valve.

Stained serial sections revealed that the intermediate tunic of the valve was composed entirely of plain muscle which, in view of what has been said on the lack of muscle in adrenal veins, must logically arise from the musculature of the caval wall.

Whilst not being strictly in the same plane of those of the tunica media of the vena cava, these muscle fibres were arranged parallel to the longitudinal fibres of the media. That is to say, they ran in the same direction as longitudinal caval fibres, transverse to the circular caval fibres, and at right angles to the periphery of the valve (Fig. II).

Discussion

The function of this adrenal valvular apparatus, of which the writer has been unable to discover mention in any of the literature, is most probably merely mechanical. That is, it must act as a physical barrier to the aspiration of the veins and medullary sinuses of the gland by the flow of blood in the larger vena cava. The fact that the apparatus is directed along the blood flow in the parent vein would seem to corroborate this point.

Fig. III illustrates both this valvular apparatus and the several apertures in the caval wall, leading from the central medullary vein of the right adrenal.

In no dissection were similar features noted in regard to the left central adrenal medullary vein. In a large number of cases, this vein was found to empty directly into the left renal vein. This observation could be regarded as lending further weight to the argument concerning the function of the right adrenal valve, for the flow of blood in the left renal vein is obviously not as great as that in the vena cava and thus, it follows that its aspiratory powers will be less.

The question of the apparatus inhibiting optimum flow of hormones from the right adrenal medulla into the vena cava, can be dismissed in a sentence.

Outpouring of adrenalin would inevitably cause contraction of the plain muscle fibres of the tunica media of the valve. Arranged as they are at right angles to the free border of the valve, any such contraction would necessarily 'shrink' the valve and doing so, would facilitate drainage of adrenal medullary venous content through a maximum aperture.

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Summary

1. The lack of plain muscle in the walls of the adrenal medullary veins of the sheep is discussed.
2. A hitherto unnoted valvular apparatus guarding the exit of the right central medullary vein into the caudal vena cava is described.
3. This valvular apparatus is shown to consist of two endothelial tunics separated by a media of plain muscle.
4. The innermost tunic is continuous with the endothelium of the central medullary vein. The outermost is confluent with that of the tunica intima of the caudal vena cava.
5. The plain muscle fibres of the media are arranged parallel to the longitudinal fibres of the vena cava, transverse to the circular caval fibres and at right angles to the free border of the valve.
6. An attempt is made to correlate function of the valve with position.

Acknowledgments

The work for this paper was carried out in the Department of Veterinary Anatomy, University of Edinburgh. My thanks are due to Mr. T. Grahame, Head of the Department, and also to Mr. R. S. Hood, who supplied the photographs.

REFERENCES

Bargmann, W. (1933): Uber den Bau der Nebennierenvenen des Menschen und der Säugetiere. *Z. Zellforsch., 17*, 118.

Ferguson, J. S. (1906): The veins of the adrenal. *Amer. J. Anat., 5*, 63.

Kolmer, W. (1918): Zur vergleichenden Histologie, Zytologie und Entwicklungsgeschichte der Säugernebenniere. *Arch. mikr. Anat. Abt., 1, 91*, 1.

Trautmann, A. and Fiebiger, J. (1952): Fundamentals of the Histology of the Domestic Animals. New York: Comstock.

A COMPARATIVE STUDY ON THE SERA PROTEINS AND LIPIDS IN TWO BREEDS OF CATTLE

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The adaptation of livestock to different environment and climatic conditions, especially to hot and dry countries such as Israel, has posed a major problem to stockbreeders. In this country, attempts have been made to solve the problem by crossing different breeds, one being selected because of its better productive qualities, and the other because of its higher resistance to the local climatic conditions.

Until 1922, the major local breeds in Israel were (a) the small, primitive and low-producing Oriental (the so-called " Arab ") cow and (b) the " Damascus " breed— the latter a slightly larger, and better milk-yielding type.

Later, Holstein-Friesian cattle were imported, on account of their much larger milk production. Because of their low resistance to the local hot and dry climate cross breeding with the Damascene breed was attempted, in order to obtain a breed endowed with the necessary stamina with regards to the climate, and a high milk yield.

Hirsch and Schindler (1957) in their work attribute the resistance to heat partly to the morphological difference between the Damascene and the Holstein-Friesian cattle.

The tolerance for heat and thirst, coupled with a low resistance to bacterial infection as displayed by the Damascene cattle (Atzmon 1957), and on the other hand the high yield of the Holstein-Friesian breed, prompted us to extend the work of Hirsch *et al.* (1957) by investigating the distribution of the serum proteins and lipids in the above-mentioned breeds.

Material and Methods

The animals used in this study were pure Damascene, and Holstein Friesian cattle. They were clinically healthy and free from tuberculosis and brucellosis. They were kept under similar conditions as to feeding and housing. A total of 20, five year old lactating cows were studied, ten from each breed, and the following investigations were carried out on their blood sera.

Protein values were established by the modified biuret methods of Kingsley (1940) and Weichselbaum (1946). Protein patterns were studied by paper-electrophoretic methods carried out in a Grassman type chamber, using a 8.6 pH buffer, μ0,1. Evaluation was made by direct densitometry of the stained strips followed by planimetration. Total cholesterol was established by the method of Rappaport and Eichhorn (1955), and the paper-electrophoretic lipoprotein pattern according to the method of Swahn (1952).

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TABLE 1.

Serum Proteins and their Paper-electrophoretic Pattern in Percentages.

Breed	*Tot. Pr.*	*Album.*	*Glob.*	*Alb/Glob.*	*Globulin Pattern* *Alb.*	*alpha*	*beta*	*gamma*
Holstein								
Friesian 10	7.54	3.40	4.05	0.84	45.3	11.4	14.0	29.3
Range	7.2-7.8	3.1-3.6	3.8-4.6		41-47	11-13	13-15	27-33
Standard deviation	±0.23	±0.21	±0.26	±0.06	±2.42	±0.87	±0.76	±2.72
Damasc.	7.08	3.9	3.18	1.22	53.5	10.1	14.4	22.0
Range	6.8-7.6	3.7-4.1	3.6-3.6		52-55	8-11	13-15.5	20-24
S.D.	±0.23	±0.15	±0.24	±0.07	±1.09	±1.09	±0.78	±1.71

TABLE 2.

Total Serum Cholesterol and Lipoprotein Distribution in Percentage and Standard Deviation.

Breed N.	*T. Ch. mg%*	*Alb.*	*Lipoprotein Distribution in percent.* *alpha*	*beta/1*	*beta/2*	*gamma*
Holstein Friesian 10	175.8	5.1	63.5	13.7	11.4	5.9
S.D.	±19.1	±0.97	±2.35	±3.28	±1.47	±1.45
Damascene 10	129	6.6	61.25	13.5	9.75	10.4
S.D.	±16.3	±1.07	±2.92	±1.73	±2.82	±3.8

Results

In table 1, we present the values for total protein and their albumin/globulin ration, as well as their paper-electrophoretic distribution. It may be observed that in the sera of the Holstein-Friesian cattle, total protein and globulin values are higher, while in the Damascene—notwithstanding their lower total protein value, higher albumin values occur than in the sera of the former. Even when taking into account the standard deviation for their total proteins as well as albumin and globulin, there is no overlapping between the value for Holstein-Friesian and Damascene cattle.

The paper-electrophoretic Bovine serum protein pattern shows the same trend in the albumin/globulin partition. As seen from Fig. 1, 4 major fractions were distinguished: A highly homogenous albumin fraction and an alpha-globulin which did not split into alpha 1 and alpha 2 (as, in the human serum) (Fig. 1), a beta globulin appearing as a compact band, and a wide gamma globulin band suggesting no homogeneity in this fraction.

When studying the values obtained in those two breeds (Table 1) and (Fig. 2 and 3) it becomes evident, that the lower albumin component, and especially the higher gamma globulin in the Holstein-Friesian (Fig. 2) are responsible for the difference in the albumin-globulin ratio in the two breeds.

The total cholestrol values obtained and the paper-electrophoretic lipoprotein patterns are shown in Table 2. The electrophoretic pattern shows five bands: One of them is situated in the albumin region containing about 5% of the total; the second contains approx. $\frac{2}{3}$ of the total and displays a mobility between albumin and alpha-globulins. The third band has a mobility somewhat less than beta and contain about 10-15%; the fourth is just behind beta and contains about 10., and the fifth, remaining at the origin, contains the hylomicrons and is referred to as gamma.

No major differences between the two breeds could be detected except for the gamma where the Damascene cattle showed a value about twice that recorded for the Holstein-Friesian breed.

While there is a close resemblance in the lipid pattern of the two breeds, their total cholestrol values are quite different from each other. Even considering the standard deviation, there is no overlapping of the respective values.

Discussion

The results of the present study differ from those found by Howe (1925) and cited by Dukes (1955). There it is stated that the albumin/globulin ratio in cattle is generally lower than 1. These findings—confirmed by the results obtained in the instance of Holstein-Friesian cattle—are not borne out in the instance of the Damascenes, the albumin/globulin ratio of which is larger than 1.

This should induce investigators to refrain from generalising on the basis of experiments carried out on a restricted number of breeds—and, therefore, the breed

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or breeds referred to ought to be clearly labelled in similar studies. In spite of lower values for proteins obtained in the Damascene cattle, the relative values of the albumin as well as the absolute values are higher. Those results were confirmed by both chemical and electrophoretic analysis.

The albumin fraction of the plasma being responsible for most of the effective osmotic pressure (West and Todd, 1957), constitutes therefore the factor governing the water-retaining capacity of blood plasma. This leads us to the conclusion, that the prolonged thirst endurance in the Damascene cow may be partly due to its higher blood-albumin levels as compared with the Holstein-Friesian. Liquid taken up by drinking and pasture-feeding is probably retained in the blood of the Damascene over a longer period.

The breeds under discussion showed not much difference concerning their alpha and beta globulin, but gamma globulin is higher in the Holstein-Friesian than in the Damascenes. As shown in Table I and Fig. 2 and 3, the gamma globulin values in the Damascene is considerably lower (22%) of the total protein as in the Holstein-Friesian (29.3%) of the total. In terms of absolute values, these figures are 1.60 mg. per 100 ml. serum (Damascene) and 2.18 mg.% (Holstein-Friesian) respectively. As it is well known, the antibodies in the sera are part of the gamma globulin complex, therefore, these values might explain at least partly the higher resistance to bacterian infection of the Holstein-Friesian cattle, compared to the Damascene.

In previous works the authors reported only three lipid fractions in cattle sera. As we were interested in the study of every possible difference, we refined our method and were thus able to demonstrate five lipoprotein fractions. However, no major differences could be observed in their distribution. The only difference observed was restricted to the total cholestrol level. The values for the Holstein-Friesian exceeded those for the Damascenes by 25%. Here, even taking into account the standard deviation, results did not overlap. The assay of total serum cholestrol is recognised as another adjunct in the appreciation (evaluation) of thyroid activity (Byers *et al.*, 1952; Huxthal *et al.*, 1941; Rosenman *et al.*, 1952). It should be emphasized in this connection that Holstein-Friesian cattle are heavier, and quieter, and have more fat than the local breeds. This could be attributed to a lower thyroid activity and consequently, to a lower metabolism.

Summary

A comparative study on the blood sera proteins and lipids and their distribution in 2 breeds of cattle (Damascenes and Holstein-Friesian) showed the following characteristics and difference.

The high milk-producing Holstein-Friesian cattle showed higher total cholestrol, total protein and gamma globulin, but a lower albumin/globulin ration than the hot and dry climate resistant Damascene cattle. In both breeds, alpha and beta globulin pattern were similar. The differences obtaining between these two breeds were discussed in this paper.

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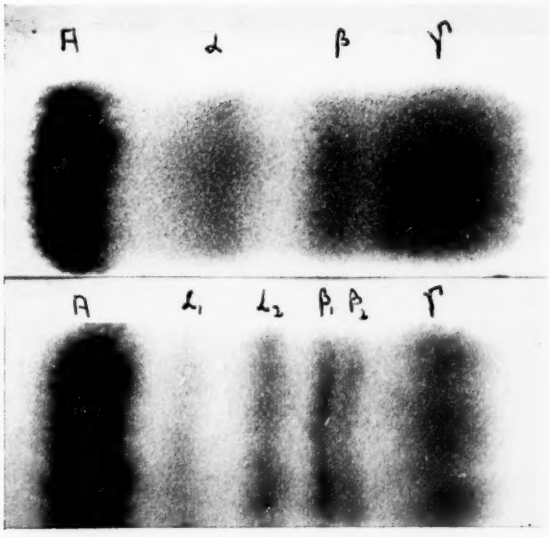

FIG. 1.

Electrophoretic serum protein pattern obtained from normal bovine (above) normal human (below)

(Article by Perk, page 411)

PLATE 5

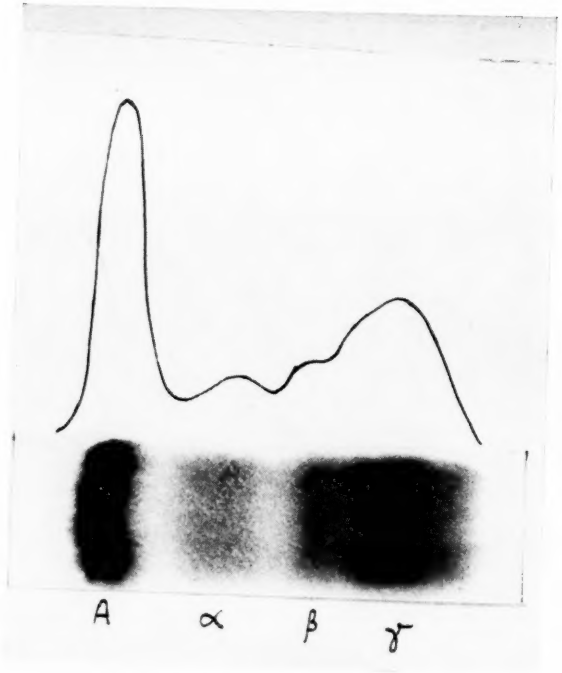

FIG. 2.
Normal Holstein-Frisian serum protein pattern.

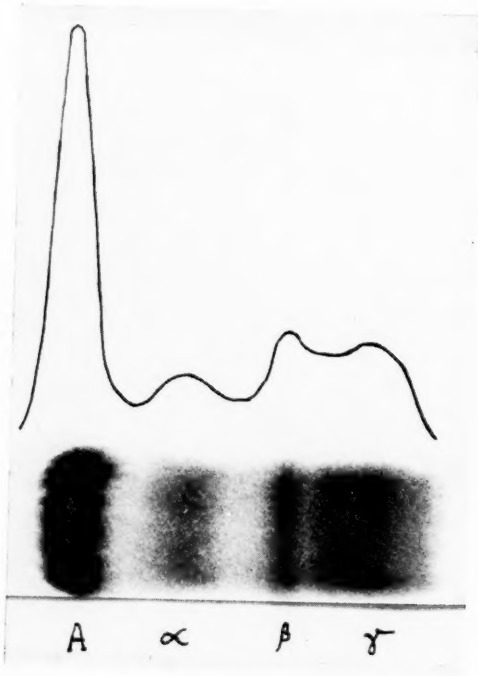

FIG. 3.
Normal Damescene serum protein pattern.

(Article by Perk, page 411)

REFERENCES

Atzmon, I. (1957): Hassedeh Publishing Co. Tel-Aviv.
Byers, S. O., Freidman M. and Roseman, R. H. (1952): *Metabolism, 1,* 479.
Dukes, H. H. (1955): *The Physiology of Domestic Animals,* Baillière, Tindall and Cox.
Hirsch, Shindler, C. (1957): *Ktavim, Bull. Agr. Res. Station Israel.* Series No. 185-E (1.40).
Howe, P. (1925): *Physiol. Rev., 5,* 439.
Hurxthal, L. M. and Simpson, H. N. (1941): *J. clin. Endocrinol., 1,* 450.
Kingsley, G. R. (1940): *J. biol. Chem., 133,* 731.
Rappaport, F., Eichhorn, F. (1955): *Rev. Méd. Córdoba, 43,* 86.
Rosenman, R. H., Friedman, M. and Byers, S. D. (1952): *J. clin. Endocrinol., 12,* 1287.
12, 1287.
Swahn, B. (1952): *Scand. J. clin. Lab. Invest., 4,* 246.
Weichselbaum, T. E. (1946): *Amer. J. chem. Path., 7,* 40.
West, E. S. and Todd, W. R. (1957): *Textbook of Biochemistry.* The Macmillan Company, N.Y.

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ELECTROCARDIOGRAPH STUDIES IN NORMAL BUFFALOES

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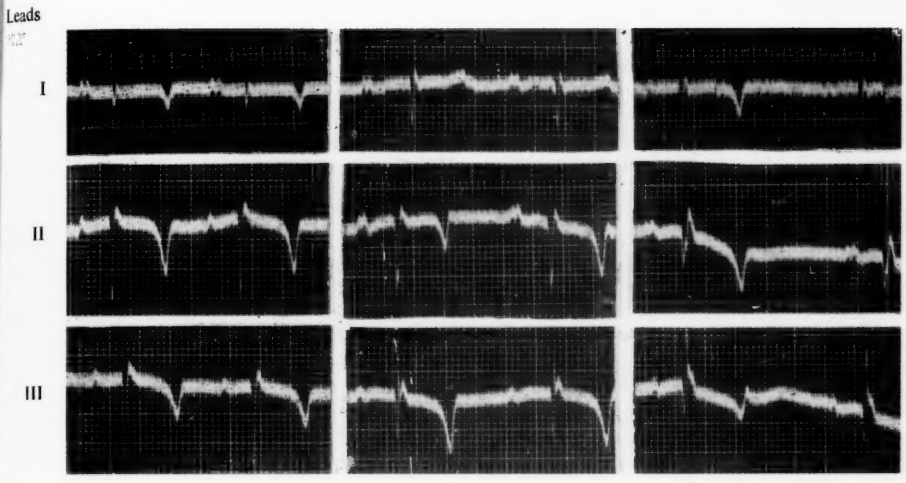
There are many records concerning the electrocardiographic study of the different phases of the cardiac cycle and the diagnosis of heart disease in man. The literature regarding the application of electrocardiography to farm animals is meagre. Amplitudes of the waves and duration of the intervals in normal dogs have been reported by Lanneck (1949) and Grollman (1952). Norr (1913), Kahn (1913), Waller (1913), Yocoel and Spitz (1937), Dukes and Batt (1941), Lanneck and Butquvist (1951), Miller and Hickman (1952), studied the variations of intervals and amplitudes in normal horses. Investigations appertaining to calves were recorded by Barnes, Davis and McCay (1938). Sykes and Alfredson (1940) and Alfredson and Sykes (1942) reported their findings on different breeds and age groups of calves. Observations on sheep and cattle, under different thyroid status, have been reported by Mullick, Alfredson and Reineke (1948) and Sykes, Thomas and Moore (1952). A detailed study of the electrocardiographic examination of sheep was made by Souza (1952). Planter, Kibler and Brody (1948) provided a great deal of information on the normal electrocardiogram of many species of farm animals.

The present study was undertaken in order to ascertain the normal values of the electrocardiogram for buffaloes. The buffalo is used in many countries for milk production and draught purposes.

Methods

35 healthy buffaloes of Murrah breed were used in this study. The age distribution ranged from 5 months to 12 years. The adult animals were in various stages of lactation, lactation with gestation and gestation without lactation. All the animals were fed on a maintenance ration of roughage and grain mixture. The diet of the growing and milch animals was supplemented with an extra quantity of grain mixture according to the recommendations of Morrison (1957). Water was given *ad lib.* The observations and the records were made early in the morning before feeding.

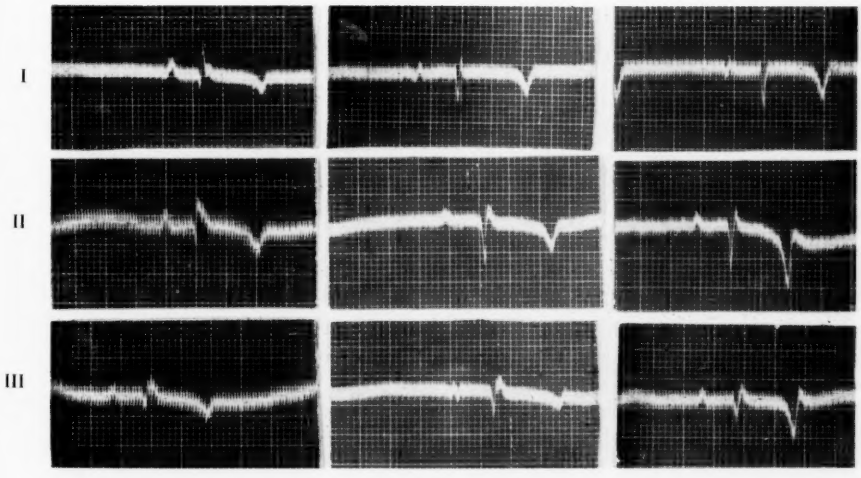
The apparatus employed was a portable Cambridge electrocardiograph powered by a 12 volt battery. The three standard leads were employed; lead I, right front leg to left front leg; lead II, right front leg to left rear leg; lead III, left front leg to left rear leg. The Cambridge German silver plate electrodes were used. The area of application was clipped and shaved, and the electrode jelly was applied and rubbed in vigorously. The electrodes were applied to the shaved areas on the outerside of the fore-legs approximately in the centre of the humerus and above the stifle on the left hind leg in the region of the lower 1/3rd of the femur. The feet were not allowed to make a wet contact with the floor. The animals were accustomed to being handled and were trained to stand quietly during the period of recording. All the



1
5 to 6 months

2
10 to 12 months

3
22 to 24 months



4
Lactating

5
Lactating and Pregnant

6
Dry and Pregnant

(Article by Mullick, page 416)

leads were standardized so that one centimeter equalled one millivolt. At least five or six complete heart beats were recorded in each lead. Records of all leads in the same animal were repeated on three consecutive days. The measurements of intervals and potentials were made in accordance with the standards advocated by the American Heart Association (1943). The nomenclature introduced by Einthoven was employed and the letters P, Q, R, S and T were assigned to the various electrocardiographic deflections.

In the human subject the heart rate has been shown to influence the QT especially and to a lesser extent the PR intervals; it was necessary therefore to determine rates so that the effect of this factor on the intervals could be ascertained. The heart rate in each lead was calculated by taking an average of five or six PR intervals. The values obtained in each lead, of the three daily tracings (nine values in all), were averaged and expressed as the heart rate. The formula described by Barker (1952) to check the calculation of heart rate was used also.

The intervals PR, QRS and QT were measured under the magnification of a reading glass. The accuracy of this method is approximately 0.01, second for all intervals. Readable complexes were always selected for measurement of intervals. Contrary to custom which is followed, as a rule, when investigations are made on human subjects, the arbitary selection of any given lead for determination of interval length is impossible for practical purposes, because of the extreme range of the cardiac electrical axis in cattle. For the sake of uniformity, and since the longest interval, in any lead, of the first daily tracing was rarely exceeded in the two subsequent records, the greatest interval in any lead of the first tracings was selected for tabulation unless there was some factor to the contrary.

Results and Discussions

The summary of the heart rate per minute derived from all the experimental animals is shown in Table I. Heart rate varied from 30-78 beats per minute with an average of 53.4 for the entire series. The animals were divided according to their age. The younger animals (5-6 months) showed highest values and the rate gradually declined as the age of the animals increased. The mean values were 71, 60 and 40 beats per minute for 5-6 months, 10-12 months and 22-24 months respectively. Similar observations in cow-calves were reported by Barnes *et al.* (1938) Sykes and Alfredson (1940), Alfredson and Sykes (1942) and Planter *et al.* (1948).

Among the adult buffaloes, animals in the late stages of pregnancy showed higher values than the lactating and lactating pregnant animals. The figures ranged from 51-62 and 32-48, average values being 56 and 40 beats per minute respectively. Thomas and Moore (1951) reported the same trend in their experimental animals, the heart rate increased from 64 to 93 beats per minute from 80 days before parturition to just before calving. The rate declined gradually from 75 to 61 beats per minute during the period just after calving to the 300th day of lactation. Several factors such as the environmental temperature, the plane of nutrition and excitement may be responsible for the variation of the heart beat. In order to minimise the effects of these variable factors, the following precautions were taken. All the

TABLE I.

Heart rate in minutes of buffaloes of different age groups based on an average of 3 leads, a summary of heart rates of other species is included for comparison.

Species		5-6 *months*	10-12 *months*	22-24 *months*	*'Pregnant' and dry*	*'Lactating' and pregnant*	*References*
Buffaloes	Min.	65	44	30	51	32	Present
	Max.	77	78	48	62	48	investigation.
	Mean	71	60	40	56	40	
Cow calves	Mean	—	82.5	—	—	—	Alfredson and Sykes (1942).
Cow calves	Mean	—	92.0	—	—	—	Planter Kibler and Brody (1948).
						Adult	
Cows	Mean					67.8	
Cows	Mean					61.0	Planter Kibler and Brody (1948).
Horses	Mean					40.0	Planter Kibler and Brody (1948).
Horses	Mean					31-44	Dukes (1955).
Sheep	Mean					112.0	Mullick, Alfredson and Reineke (1949).
Sheep & Goat	Mean					70-80	Dukes (1955).
Dog	Mean					70-120	—ibid—
Man	Mean					60-90	—ibid—

observations were recorded during summer months (April to June), the diet was arranged according to a prescribed schedule, all the tracings were recorded in the early morning when the effects due to feeds were minimum, and the animals were trained thoroughly for this work before tracings were taken.

The figures of the heart rate of the lactating and lactating pregnant groups of buffaloes in the present investigation (41.5) was as reported by Mullick and Kehar (1951).

The duration of PR interval as shown in table II, ranged from 0.15 to 0.32 seconds, with an average duration of 0.22 seconds in all the groups. In most instances, the duration of PR was very nearly equal in all the leads. Taking lead II as a standard, usually the values in leads I and II were within 0.01 second of this value. This difference was exceeded only very rarely. The duration of the PR interval varied rather consistently with heart rate. It will be noted from Tables I and II that the mean value of PR increased regularly as the heart rate decreased with the age, the mean values were 0.18, 0.19, 0.23, 0.24 and 0.24 seconds for 5-6 months, 10-12 months, 22-24 months and adult buffaloes respectively. It was noted also that the PR interval was shorter in young than in mature animals, 0.19 seconds for 10-12 months calves and 0.24 seconds for pregnant and dry buffaloes, even though the heart rates were comparable. From the figures of PR interval of different species in Table II it can be seen that the mean interval for adult buffaloes was always higher than that for cattle and sheep and lower than for horse. It is evident from these data that the effect of heart rate on this interval should be taken into consideration before conclusions are drawn concerning the significance of changes in PR intervals.

The duration of QRS ranged from 0.04 to 0.09 seconds with an average value of 0.064 seconds (Table II). The lower values 0.04 to 0.08 seconds with an average of 0.06 were found consistently in young animals. The distribution about the mean was quite close. Probably, one of the factors responsible for the lesser variation in the QRS intervals might be due to the fact that it did not vary with heart rate to such an extent as did PR and QT. There was very little variation in the duration of QRS between the leads in any given electrocardiogram.

Variations in interval length between serial electrocardiograms of individuals were relatively infrequent in lead II, they were usually within the range of 0.1 to 0.2 seconds. The greatest difference was seen in leads I and III where deviations of even 0.04 seconds were found occasionally. Since these were the unfavoured leads, these variations might be expected. Changes in the length of this interval, coincident with variations in heart rate, were noted but to a lesser extent than were those of PR and QT but the increase in the mean values of this interval with the decline in the heart rate was consistent.

Between the species, the cow calves and cows showed higher value in the interval of QRS than buffaloes, though the heart rate was less. On the other hand the heart rates were practically the same in buffalo and horse but the duration was more in horse.

The QT interval ranged from a minimum of 0.22 to a maximum of 0.59 second. The average duration of the entire group was 0.39 second. The variations of the interval in younger animals were from 0.22 to 0.48 seconds with an average value of

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TABLE II.

Duration of PR, QRS and QT intervals and a summary of the results of other species is included for comparison.

Species	*P.R. interval Sec.*			*QRS intervals Sec.*			*QT intervals Sec.*			
Buffalo	*Min.*	*Max.*	*Mean*	*Min.*	*Max.*	*Mean*	*Min.*	*Max.*	*Mean*	
5-6 months	0.15	0.22	0.18	0.05	0.07	0.06	0.22	0.31	0.26	Present investigation.
10-12 months	0.15	0.25	0.19	0.04	0.07	0.06	0.32	0.40	0.35	
22-24 months	0.19	0.27	0.23	0.04	0.08	0.06	0.38	0.48	0.43	
P and D	0.19	0.29	0.24	0.04	0.09	0.06	0.35	0.47	0.44	
L and P	0.23	0.32	0.24	0.06	0.09	0.08	0.44	0.59	0.49	
Calves	0.13	0.17	0.15	0.06	0.09	0.07	0.38	0.44	0.40	Sykes and Alfredson (1940).
Cows	0.10	0.30	0.19	0.06	0.12	0.09	0.29	0.47	0.39	Alfredson and Sykes (1942).
Cows	0.16	0.25	0.19	0.07	0.11	0.09	0.33	0.45	0.41	Planter, Kibler and Brody (1948).
Horses	0.20	0.42	0.30	0.08	0.17	0.12	0.46	0.62	0.54	Dukes (1955).
Sheep	0.08	0.14	0.10	0.02	0.04	0.04	0.22	0.32	0.27	Mullick, Alfredson and Reineke (1949).

P—Pregnant. D—Dry. L—Lactating.

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0.35 second. The greater spread of the distribution of the QT values in comparison to those for QRS might, in the main, be due to the fact that QT varied with heart rate to a greater extent than did QRS.

The duration of QT varied consistently with the heart rate in an inverse ratio and since a higher rate was common in younger animals. The values for QT of those under 12 months were usually less than those of mature animals. A progressive increase in duration of QT was recorded with the gradual decline in the heart rate. When all the intervals, PR, QRS and QT are considered in the different species it can be seen that the interval of PR and QT were longer and QRS was shorter in buffaloes than in domesticated cattle calves or cows. Though the heart rate of the latter group was about 20 beats more, the heart rates of horse and adult buffalo were practically the same but the figures of all the intervals in horse were higher (Table II). The intervals noted in sheep were the lowest within the range of farm animals.

Monophasic P waves, consisting of an upward or positive deflection, were the common types found in all the leads (figure I). In one instance only a negative monophasic wave was encountered. Monophasic waves were very common in all the leads in all the groups. In some cases, double P waves were noted. The P waves which were found in three leads are summarized in table III.

The occurrence of the individual deflections of QRS was as follows: Q whether positive or negative appeared 5 times in lead I, 6 times in lead II and 10 times in lead III and all were negative; R appeared 4 times positive and 31 times negative in lead I; 9 times positive and 25 times negative in lead II and 9 times positive and 24 times negative in lead III. S was found 18 times positive and one time negative in lead I; 26 times positive and none negative in lead II and 23 times positive and nil negative in lead III (table III).

In most instances QRS did not resemble closely the QRS seen in the electrocardiograms of normal human subjects. This is very difficult to explain, though it is possible that this dissimilarity might be due to one or both of the two factors. It may be due to the fact that the position of the heart in the chest cavity is different in the two species and since the form of QRS depends, in part at least, on the relation of the electrical axis of the heart to the leads, this anatomical difference could account in part for the dissimilarity of QRS in the electrocardiograph of cattle and men. It seems that the spread of the impulse in the bovine heart is different from that in man. Cardwell and Aramson (1931) showed that the distribution of the Purkinje net work was different in the two species and Alfredson and Sykes' (1940) observations on bundle branch block tended to confirm this finding.

The deflection of T wave like the P wave, represented characteristics rarely encountered in human tracings. Diphasic T waves occurred much more frequently in cattle than they did in the human subject. They were usually present in the records of one or more of the leads of most electrocardiograms. A great proportion of the monophasic T waves were negative. Table III summarized the occurences of the various combinations of T waves.

The potential of the electrocardiographic deflections in table III showed the range of the potentials for each wave as they were observed in the three leads. Positive P waves were found in all the leads. Lead II however, showed the greatest mean

TABLE III.

Distribution of amplitudes in millimeters in leads I, II and III in electrocardiograms of buffaloes. (The number of animals measured is shown by the figures in parenthesis). In a few cases, records are not available.

Wave form	*Leads*	5-6 *months*		10-12 *months*		22-24 *months*		*Pregnant*		*Lactating*	
P I	+	0.15-0.20	(3)	0.10-0.20	(5)	0.10-0.20	(8)	0.05-0.15	(7)	0.05-0.20	(8)
	−	—		—		—		0.05	(1)	—	
II	+	0.20	(2)	0.10-0.20	(6)	0.10-0.20	(8)	0.10-0.20	(8)	0.10-0.20	(8)
	−	—		—		—		—		—	
III	+	0.15-0.20	(3)	0.10-.20	(4)	0.05-0.15	(7)	0.05-0.10	(6)	0.05-0.10	(5)
	−	—		—		—		—		—	
Q I	+	—		—		—		0.10	(1)	0.10	(1)
	−	—		—		—		0.10	(1)	0.10	(2)
II	+	—		—		—		—		—	
	−	0.30	(1)	—		0.20	(1)	0.20	(2)	0.20	(2)
III	+	—		—		—		—		—	
	−	0.20	(1)	—		0.20-0.25	(3)	0.20-0.40	(3)	0.10-0.20	(3)
R I	+	—		—		—		0.30-0.35	(2)	0.40-0.50	(2)
	−	0.35-0.65	(3)	0.70-1.20	(6)	0.30-1.10	(8)	0.10-0.9	(6)	0.15-0.70	(8)
II	+	0.30	(1)	—		0.20-0.30	(2)	0.20-0.55	(2)	0.26-0.50	(4)
	−	1.40	(1)	0.30-1.00	(6)	0.50-1.30	(6)	0.20-0.90	(6)	0.45-0.70	(6)
III	+	—		—		0.25-0.80	(3)	0.20-0.70	(3)	0.20-0.60	(3)
	−	0.30-0.70	(3)	0.30-1.20	(4)	0.30-1.30	(5)	0.10-0.40	(5)	0.20-0.50	(7)
S I		0.05-0.40	(2)	0.15-0.35	(3)	0.05-0.35	(7)	0.05-0.10	(2)	0.10-0.15	(4)
	−	—		—		—		0.15	(1)	—	
II		0.15-0.40	(2)	0.20-0.75	(6)	0.20-0.40	(8)	0.20-0.30	(4)	0.15-0.30	(6)
	−	—		—		—		—		—	
III		0.20-0.40	(3)	0.10-0.40	(4)	0.20-1.10	(7)	0.10-0.55	(5)	0.10-0.20	(4)
	−	—		—		—		—		—	
T I		—		0.20-0.50	(4)	—		0.15	(1)	—	
	−	0.10-0.24	(3)	0.55-0.60	(2)	0.25-0.90	(8)	0.05-0.45	(7)	0.10-0.50	(10)
II		—		—		—		0.30	(1)	—	
	−	0.10-0.25	(2)	0.25-0.85	(6)	0.25-1.30	(8)	0.10-0.50	(7)	0.50-0.70	(10)
III		—		0.15-0.20	(2)	0.10-0.15	(2)	0.10-0.20	(4)	0.10-0.25	(3)
	−	0.15-0.60	(3)	0.20-0.80	(2)	0.10-0.20	(4)	0.10-0.40	(6)	0.10-0.50	(7)

value for this deflection. Very few Q waves were recorded and these were in adult animals only. In the case of R it was recorded in all the leads but the greatest deflection was found in lead II. There were more negative deflections in R. The potential of S was uniformly positive and small as compared to the other deflections of QRS. The values were practically the same in all the leads. The largest negative potential of T wave was found in leads II and III. Lead II showed the highest value.

It is a known fact that in the human subject the potentials of QRS deflection are correlated with the nutritional state of the heart muscle but in the present observation, the potentials of the waves gradually decline with the increase in the age of the animals. These experimental animals were supplied with optimum quantity of all essential nutrients. The comparison of their nutritional status from the height of the waves can not be judged in this particular observation. Age might play an important part in the variation of the deflection of the waves.

There were little variations in the potentials of different waves between lactating and lactating and pregnant buffaloes. Alfredson & Sykes (1942) likewise were unable to detect any difference in the electrocardiogram in these classes of cows. It would be desirable to make observations on a large number of animals over the whole period of gestation and lactation in order to determine the effect of these factors accurately.

Summary and Conclusion

Electrocardiographic data and their analysis obtained for young calves (5-24 months), lactating, lactating and pregnant and dry and pregnant dairy buffaloes, are summarized as follows:

The average heart rate of all the experimental animals was 53.4 beats per minute. The rate for animals up to 12 months of age was significantly higher (65.5). In animals over 12 months the rate was 45.3 beats per minute and pregnant animals over 6 months had higher rate than the lactating and lactating pregnant ones. These figures were lower than those reported for dairy cows but they approached closely the average rate of horses.

The duration of QT and to a lower extent PR was inversely proportional to the heart rate with greater range of minimum and maximum values. The QRS interval also varied with heart rate but it was neither so pronounced nor as constant as with the PR and QT intervals. The distribution of the values about the mean was quite close.

The form and occurrence of the various deflections P, QRS and T have been discussed. The potentials had positive correlation with the heart rate and age of the experimental animals. The potentials of all the waves were higher in the latter stages of gestation than in lactation.

Electrocardiograms of buffaloes were quite different from those of man, except the intervals and length of various waves which were almost similar in the two species. In general the form and potential of the deflections were different.

The values of cattle, horse, dog, sheep and man have been shown for comparison.

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Acknowledgment

The author is grateful to Mr. P. G. Pande, M.Sc., M.R.C.V.S., the Director of the Institute for permission to publish this work and to Dr. N. D. Kehar, M.Sc., Sc.D., the then Head of the Animal Nutrition Division for giving all facilities during this investigation.

REFERENCES

Alfredson, B. V. and Sykes, J. F. (1940): Studies on the bovine electrocardiogram, II. Bundle branch block, *Proc. Soc. exp. Biol.* N.Y., 43, 500-584.

Alfredson, B. V. and Sykes, J. F. (1942): Electrocardiograph studies in normal dairy cattle, *J. agric. Res.*, 65, 61-87.

American Heart Association, Report of the committee on the standardization of electrocardiographic nomenclature (1943): *Amer. Heart J.*, 25, 528-534.

Barker, J. M. (1952): *The unipolar electrocardiogram, a clinical interpretation,* Appleton-Century-Crofts., Inc., N.Y.

Barnes, L. L., Davies, G. K. and McCay, C. M. (1938): Intervals in the electrocardiograms of calves fed with cod liver oil, *Connell Vet.*, 28, 16-22.

Cardwell, J. C. and Abramson, D. I. (1931): The auriculo-ventricular connection system of the beef heart, *Amer. J. Anat.*, 49, 167-192.

Dukes, H. H. and Batt, H. T. (1941): *Amer. J. Physiol.*, 365.

Dukes, H. H. (1955): *Physiology of domestic animals,* Baillière, Tindall and Cox, London.

Grollman A. (1952): Electrocardiogram of the normal dog and its alteration in acute malignant hypertension induced by lateral nephrectomy, *Amer. J. Physiol.*, 169, 74-84.

Kahn, R. H. (1913): Quoted by Alfredson and Sykes, (1942).

Lannek, N. (1949): *A clinical and experimental study of the electrocardiogram in dogs.* Stockholm.

Lannek, N. and Rutqvist, L. (1951): Normal area of variation for the electrocardiogram of horses, *Nord. Vet. Med.*, 3, 1094-1102.

Miller, W. C. and Hickman, J. (1952): Electrocardiography in the horse, *Vet. Rec.*, 64, 688-696.

Morrison, F. B. (1957): Feeds and feeding, Morrison Publishing House, U.S.A.

Mullick, D. N., Alfredson, B. V. and Reineke, E. P. (1948): Influence of thyroid status on the electrocardiogram and certain blood constituents of the sheep, *J. Amer. Physiol.*, 152, 100-105.

Mullick, D. N. and Kehar, N. D. (1951): Comparative heat tolerance test in cattle and buffalo,

Norr, J. (1913): quoted by Alfredson and Sykes (1942).

Planter, W. S., Kibler, H. H. and Brody, S. (1948): Electrocardiograms of mules, horses, cattle, sheep, swine, and goats. *Res. Bull. Mo. agric. Exp. Sta.* 419.

Souza, O. A. (1952): *The action of areosthetics and ions on the heart of the sheep as recorded by the electrocardiogram.* Thesis, Cornell Univ.

Sykes, J. F. and Alfredson, B. V. (1940): Studies on the bovine electrocardiogram, electrocardiographic changes in calves on low potassium ration, *Proc. Soc. exp. Biol.*, 43, 575-579. *J. Anim. Sci.*, 9, 1078 (Abstract).

Sykes, J. F. and Alfredson, B. V. (1940): Studies on the bovine electrocardiogram: electrocattle fed thyroprotein, *J. Anim. Sci.*, 11, 693-703.

Thomas, J. W. and Moore, L. A. (1951): Variations in the heart rate of dairy cows, *J. Dairy Sci.*, 34, 321-328.

Waller, A. D., (1913): Electrocardiogram in horse, *J. Physiol.*, 47, 32-34.

Yacoel, J. and Spitz, G. (1937): quoted by Alfredson and Sykes (1942).

REVIEWS

SPEZIELLE PATHOLOGIE UND THERAPIE DER HAUSTIERE (1959). Hutyra and Marek. 11th Edit. by R. Manninger and J. Mócsy. 2 Vols. Jena. Gustav Fischer. D.M. 123.

This is the eleventh edition of the work of F. von Hutyra and J. Marek on Special Pathology and Therapeutics of Domesticated Animals which was published for the first time in 1905. The present edition is in two volumes and the first by R. Manninger deals with the infectious diseases and consists of 956 pages and 319 figures; the second of 1004 pages and 445 figures describes the diseases of the organs and is by J. Mócsy; both authors are University professors at Budapest.

Standard accounts are given of the acute infections such as anthrax, pasteurellosis, rickettsial diseases, leptospirosis, piroplasmosis, rinderpest and swine fever. The acute exanthemata are grouped together and they include the poxes and foot and mouth disease. Acute infections with localization in a particular organ are considered next in order and these include strangles, tetanus, louping ill, and infections of the lungs. The chronic infections complete volume one with glanders, tuberculosis, brucellosis, trichomoniasis and other similar diseases. The arrangement is therefore based on the morbid- anatomical picture and not in accordance with the nature of the infective agent; it is somewhat similar to that found in volume two which begins with those conditions affecting the mouth, throat and salivary glands. This is followed by accounts of disease conditions in the remaining parts of the alimentary tract. Disorders of the respiratory tract, the skin, the blood, the nervous system and of the other organ-systems are considered in a like manner.

Liberal accounts are given and the descriptions are aided by black and white and by coloured figures. References are made to the work of many authors but the value of this aspect is reduced because of the absence of the corresponding bibliography. The history, aetiology, species attacked, symptoms, pathogenesis, morbid anatomy, diagnosis, treatment and control are all considered. Synonyms are given and if an infection is known in man a section may be devoted to it.

To those well versed in the German tongue this edition will be welcome and valuable. It gives orthodox accounts of the diseases of domestic animals which are met throughout the world. Some of the recent advances in knowledge are included and the linkage with human disease is not forgotten. Each volume has an index but there are no cross references and in some cases one has to search both volumes. For example, botulism, scabies and bovine pyelnephritis are not found among the infectious diseases, but are discovered in volume two with those diseases affecting specific organs.

In spite of the defects, the new edition of Hutyra and Marek will persist as a standard text book for those veterinary surgeons and students who read German.

STRONTIUM 90 IN HUMAN DIET IN THE UNITED KINGDOM, 1958, *A.R.C. Radiobiological Laboratory.* Rep. No. 1, 1959, London, H.M.S.O. 75 pp. + x. 4/-.

In 1957 the responsibility for investigating the contamination of human food and agricultural land with radioactive substances was entrusted to the Agricultural Research Council. This survey came into operation in 1958; its ultimate objective being the measurement of the ratio of strontium 90 to calcium in the diet.

Calcium and strontium 90 are laid down together in bone and the latter may be retained for long periods and the resultant irradiation depends on its concentration. Milk, being the sole diet of infants and because it is the principal food whereby strontium 90 may enter human diet, was examined extensively. The mean concentration was estimated as 8 micro microcuries per litre or 7 micro microcuries per gramme

of calcium. The concentration varied in different parts of the country depending largely on the rain-fall.

Representative samples of flour, potatoes and green vegetables were also examined and it is estimated that the mean ratio of strontium 90 to calcium in the diet of the whole population for 1958 is about 6 micro microcuries per gramme. The maximum level which might have been approached under extreme conditions is estimated at 23 micro microcuries per gramme of calcium, but there is no evidence of diet approaching this level being consumed by even a few persons.

It is concluded from other observations and calculations that the level of strontium 90 in the bones of the general population should not exceed 100 micro microcuries per gramme of calcium. The quantity of strontium 90 in diet which would cause this level to be reached is over six times greater than the average in the United Kingdom diet during 1958.

The observations upon which the summary is based are described in the text of the report and illustrated in 16 tables, 13 figures and six appendices.

QUANTITATIVE METHODS IN HUMAN PHARMACOLOGY AND THERAPEUTICS. Edited by D. R. Laurence. London. Pergamon Press, 1959. 253 pages. 45/-.

This is the third volume in the Biological Council's Co-ordinating Committee for Symposia on Drug Action series, and it contains the proceedings of a symposium held in London on 24th and 25th March, 1958.

The symposium was divided into three parts; firstly Methods and Problems associated with the Evaluation of Drugs in Man, secondly Newer Statistical Methods applicable to Human Pharmacology and Therapeutics, and finally the Introduction of Drugs into Clinical Practice and Clinical Trials.

All the contributions are of a very high order. The distinguished contributors came not only from the United Kingdom, but also from Europe and the United States of America. The proceedings of this symposium will be of interest to all those concerned with the problems of pharmacology and therapeutics.

Reading this volume one realises the advantage of dealing with animals, where the introduction and evaluation of a new drug is not such a complex problem.

NEWS

THE WELLCOME FOUNDATION

The Wellcome Foundation announce the issue of two new vaccines against epidemic diseases of dogs.

The first is '*Epivax-Plus*', a combined vaccine which combines in one vaccine protection against three different diseases—distemper, hard-pad and contagious hepatitis.

It provides the full protection against hard-pad and distemper given by 'Epivax', and an active and lasting protection against contagious hepatitis also. Being a "live" vaccine it gives a better, quicker and a more lasting protection than an inert vaccine. Only one injection is required. This vaccine may be given to puppies when they are nine weeks of age.

The second, '*Faunolen*' is the first live vaccine to be developed against hepatitis. Its merits are that it gives safe, quick and persistent protection. One injection only is required. It may be injected into puppies when they are only three weeks old. This is of the first importance since the greatest danger from this disease lies in the first six weeks of life, although older dogs may be affected. By vaccinating the dam it is possible to ensure that the puppies are born with some immunity against hepatitis.

CARE OF AIRBORNE MONKEYS

New British Standard recommendations have been published which give guidance to airlines on the handling of rhesus and other small monkeys (up to 10 lb.), intended for laboratory use.

The recommendations (B.S. 3149, Part 1)—which have been drawn up in collaboration with airline companies, the R.S.P.C.A., the Zoological Society, and many other interested organizations—specify sizes of travelling cages to ensure that each monkey has adequate space during its journey. For the airline staff who will care for the monkeys during flight, there is helpful advice on feeding and watering the animals (3 ozs. of feed and ¼ pint of water a day at least); on ventilation; light and temperature; and on what to do in the event of sickness or injury.

Apart from dealing with the actual care of the monkeys, this standard is also concerned with the health of the animal handlers, and recommends that they produce evidence of fitness—including freedom from active tuberculosis. The compilation of an approved list of animal handlers, and of agents of importing firms, is in course of preparation.

These standard recommendations, based on valuable background work carried out by the Medical Research Council, will be followed by others dealing with various mammals, birds, fish, reptiles and invertebrates.

Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1. Price 4/- (postage will be charged extra to non-subscribers).

IVth INTERNATIONAL CONGRESS ON ANIMAL REPRODUCTION

The 4th International Congress on Animal Reproduction has been arranged for June 5th-9th, 1961, in the Hague.

Experts from all over the world will be invited to report. Meetings will cover the physiology and pathology of reproduction and artificial insemination. Problems in the reproduction of poultry will be included.

The official languages of the congress will be English, French, and German.

Details of the congress will be published in the spring of 1960. Those interested please apply to the Secretariat of the 4th International Congress on Animal Reproduction, 14 Burgemeester de Monchyplein, The Hague (Netherlands).

THE LONDON MEDICAL EXHIBITION

New and important medical products will be on show at the London Medical Exhibition, which is to held in the New Hall of the Royal Horticultural Society, from November 16th to 20th, 1959.

The Exhibition will also feature a variety of medical films to be shown daily.

Among the newer products to be exhibited will be a plastic sterile syringe which is thrown away after one use, thus eliminating the danger of cross infection.

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APPOINTMENTS

Dow Agrochemicals Limited has appointed Mr. F. G. Brown, M.A.(Cantab.), to the post of Veterinary Advisory Officer. Mr. Brown will be concerned with the development of Dow's new veterinary products in this country and co-ordinate trials with veterinary consultants, universities, and research organisations.

Mr. Brown was formerly with Smith, Kline and French Laboratories, where he served as veterinary advisor for two and a half years. Prior to that he practised as a veterinary surgeon for seven years.

Dr. K. J. Lynes, Works and Production Director of Pfizer Ltd., has been appointed a director of Kemball, Bishop & Co. Ltd.

A native of Coventry, Dr. Lynes graduated as a B.Sc. at Birmingham University in 1941 and took a Ph.D. in 1948. He joined the research and development department of The Distillers Co. Ltd., and from 1949 to 1954 was in the fermentation department of Glaxo Laboratories.

NOTICES

Burroughs Wellcome & Co. announce the issue of ' Fomodox ' brand Compound Pessaries (Veterinary). Each pessary contains streptomycin sulphate (250,000 I.U.) polymyxin B sulphate (25,000 I.U.) and stilboestrol (10 mgm.) in an effervescent disintegrating base. The stilboestrol is incorporated in the substance of the pessary, using an entirely new pharmaceutical process, and is so dispersed throughout the pessary that the effective dose of this hormone is thereby reduced. ' Fomodox ' pessaries are packed in plastic boxes of six.

Glaxo Laboratories Ltd. announce that ' equine tetanus toxoid ' is available. Box containing 6 x 2 ml. vials, each vial representing a single dose.

Publisher's Notices

THE BRITISH VETERINARY JOURNAL, with which is incorporated THE VETERINARY JOURNAL, is published monthly, and copy for advertisements should be in the hands of the advertisement manager not later than the 20th of the preceding month, if proof is required. Tel.: Temple Bar 3386, 7, 8 & 9.

Letters for the Journal, literary contributions, reports, notices, books for review, exchanges, new instruments or materials, and all matter for publication (except advertisements) should be addressed to the Editor.

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